

## CLAIM AMENDMENTS

1 Claim 1 (currently amended): A hybrid battery power source for implantable medical use,  
2 comprising:

3 a primary battery;  
4 a secondary battery connected to receive power from said primary battery;  
5 said secondary battery being adapted to power to an implantable medical device designed  
6 for high energy electrical stimulation of body tissue for therapeutic purposes; and  
7 a charge control circuit powered by said primary battery and including voltage reference  
8 and window comparator means for charging said secondary battery while limiting  
9 charge/discharge excursions thereof ~~in a manner that optimizes its output for high energy medical~~  
10 ~~device use to control discharge capacity fade and internal resistance increase during service of~~  
11 said secondary battery.

1 Claim 2 (original): A hybrid battery power source in accordance with Claim 1 wherein said  
2 charge control circuit is a pulse output circuit adapted for variable pulse width or duty cycle  
3 control, thereby allowing it to operate over a range of voltages output by said primary battery.

1 Claim 3 (currently amended): A hybrid battery power source in accordance with Claim 1 wherein  
2 said charge control circuit is adapted to charge said secondary battery over a charge/discharge  
3 excursion range that is below a maximum state-of-charge of said secondary battery ~~and which is~~  
4 ~~selected to control discharge capacity fade and internal resistance increase during service of said~~  
5 ~~secondary battery.~~

1 Claim 4 (original): A hybrid battery power source in accordance with Claim 1 wherein said  
2 voltage reference and window comparator means includes first and second voltage comparators,  
3 said first voltage comparator being adapted to initiate charging when said secondary battery falls  
4 below a minimum voltage provided by a first voltage reference and said second voltage

5 comparator being adapted to terminate charging when said secondary battery is charged to a  
6 maximum voltage provided by a second voltage reference.

1 Claim 5 (original): A hybrid battery power source in accordance with Claim 4 further including a  
2 pulse generator powered by said primary battery, said pulse generator being adapted to supply  
3 pulsatile power to said first and second voltage comparators and said first and second voltage  
4 references in order to conserve energy supplied by said primary battery to said charge control  
5 circuit.

1 Claim 6 (original): A hybrid battery power source in accordance with Claim 1 wherein said  
2 primary battery is selected from the group consisting of lithium-carbon monofluoride batteries,  
3 lithium-bromine chloride batteries, lithium-sulfuryl chloride batteries, lithium thionyl chloride  
4 batteries, lithium-manganese dioxide batteries, lithium-silver vanadium oxide batteries and  
5 lithium-iodide batteries, and wherein said secondary battery is selected from the group consisting  
6 of lithium-ion batteries.

1 Claim 7 (original): A hybrid battery power source in accordance with Claim 1 further including a  
2 voltage boost circuit that facilitates charging of said secondary battery at a voltage that is higher  
3 than a voltage output of said primary battery.

1 Claim 8 (original): A hybrid battery power source in accordance with Claim 7 wherein said  
2 voltage boost circuit comprises one of an inductive element or flyback transformer.

1 Claim 9 (original): A hybrid battery power source in accordance with Claim 7 wherein said  
2 voltage boost circuit comprises a capacitive charge storage device.

1 Claim 10 (original): A hybrid battery power source in accordance with Claim 9 wherein said  
2 voltage boost circuit is adapted to produce charging pulses of sufficiently short duration to reduce  
3 the discharge rate of said primary battery to a level that is compatible with the maximum

4 discharge current capacity thereof.

1 Claim 11 (currently amended): An implantable medical device for high energy electrical  
2 stimulation of body tissue for therapeutic purposes, comprising:

3 a pair of electrical contacts adapted to provide electrical stimulation to body tissue;  
4 energy storage means adapted to provide electrical energy to said electrical contacts;  
5 switching means adapted to periodically interconnect said energy storage means to said  
6 electrical contacts; and

7 a hybrid battery power source adapted to provide power to said energy storage means and  
8 including:

9 a primary battery;

10 a secondary battery connected to receive power from said primary battery and to provide  
11 power to said energy storage means; and

12 a charge control circuit powered by said primary battery and including voltage reference  
13 and window comparator means for charging said secondary battery while limiting  
14 charge/discharge excursions thereof ~~in a manner that optimizes its output for high energy medical~~  
15 ~~device use to control discharge capacity fade and internal resistance increase during service of~~  
16 said secondary battery.

1 Claim 12 (original): An implantable medical device in accordance with Claim 11 wherein said  
2 charge control circuit is a pulse output circuit adapted for variable pulse width or duty cycle  
3 control, thereby allowing it to operate over a range of voltages output by said primary battery.

1 Claim 13 (currently amended): An implantable medical device in accordance with Claim 11  
2 wherein said charge control circuit is adapted to charge said secondary battery over a  
3 charge/discharge excursion range that is below a maximum state-of-charge of said secondary  
4 battery ~~and which is selected to control discharge capacity fade and internal resistance increase~~  
5 ~~during service of said secondary battery.~~

1 Claim 14 (original): An implantable medical device in accordance with Claim 11 wherein said  
2 voltage reference and window comparator means includes first and second voltage comparators,  
3 said first voltage comparator being adapted to initiate charging when said secondary battery falls  
4 below a minimum voltage provided by a first voltage reference and said second voltage  
5 comparator being adapted to terminate charging when said secondary battery is charged to a  
6 maximum voltage provided by a second voltage reference.

1 Claim 15 (original): An implantable medical device in accordance with Claim 14 further  
2 including a pulse generator powered by said primary battery, said pulse generator being adapted  
3 to supply pulsatile power to said first and second voltage comparators and said first and second  
4 voltage references in order to conserve energy supplied by said primary battery to said charge  
5 control circuit.

1 Claim 16 (original): An implantable medical device in accordance with Claim 11 wherein said  
2 primary battery is selected from the group consisting of lithium-carbon monofluoride batteries,  
3 lithium-bromine chloride batteries, lithium-sulfuryl chloride batteries, lithium thionyl chloride  
4 batteries, lithium-manganese dioxide batteries, lithium-silver vanadium oxide batteries and  
5 lithium-iodide batteries, and wherein said secondary battery is selected from the group consisting  
6 of lithium-ion batteries.

1 Claim 17 (original): An implantable medical device in accordance with Claim 11 further  
2 including a voltage boost circuit that facilitates charging of said secondary battery at a voltage  
3 that is higher than a voltage output of said primary battery.

1 Claim 18 (original): An implantable medical device in accordance with Claim 17 wherein said  
2 voltage boost circuit comprises one of an inductive element or flyback transformer.

1 Claim 19 (original): An implantable medical device in accordance with Claim 17 wherein said  
2 voltage boost circuit comprises a capacitive charge storage device.

1 Claim 20 (original): An implantable medical device in accordance with Claim 19 wherein said  
2 voltage boost circuit is adapted to produce charging pulses of sufficiently short duration to reduce  
3 the discharge rate of said primary battery to a level that is compatible with the maximum  
4 discharge current capacity thereof.

1 Claim 21 (currently amended): A method for powering an implantable medical device designed  
2 for high energy electrical stimulation of body tissue for therapeutic purposes, comprising:  
3 providing a primary battery;  
4 providing a secondary battery and connecting it to receive power from said primary power  
5 battery;  
6 connecting said secondary battery to power said implantable medical device;  
7 periodically monitoring the charge state of said secondary battery; and  
8 periodically charging said secondary battery by way of said primary battery while limiting  
9 charge/discharge excursions of said secondary battery ~~in a manner that optimizes its output for~~  
10 high energy medical device use to control discharge capacity fade and internal resistance increase  
11 during service of said secondary battery.

1 Claim 22 (original): A method in accordance with Claim 21 wherein said charging is performed  
2 under variable pulse width or duty cycle control over a range of voltages output by said primary  
3 battery.

1 Claim 23 (currently amended): A method in accordance with Claim 21 wherein said charging  
2 comprises charging said secondary battery over a charge/discharge excursion range that is below  
3 a maximum state-of-charge of said secondary battery ~~and which is selected to control discharge~~  
4 ~~capacity fade and internal resistance increase during service of said secondary battery.~~

1 Claim 24 (currently amended): A method in accordance with Claim 21 wherein said monitoring  
2 ~~comprising~~ comprises a first periodic comparison to initiate charging when said secondary

3 battery falls below a minimum voltage and a second periodic comparison to terminate charging  
4 when said secondary battery is charged to a maximum voltage.

1 Claim 25 (original): A method in accordance with Claim 24 wherein said first and second  
2 comparisons are performed using pulsatile energy delivered by said primary battery in order to  
3 conserve energy supplied by said primary battery for said first and second comparisons.

1 Claim 26 (original): A method in accordance with Claim 21 wherein said primary battery is  
2 selected from the group consisting of lithium-carbon monofluoride batteries, lithium-bromine  
3 chloride batteries, lithium-sulfuryl chloride batteries, lithium thionyl chloride batteries, lithium-  
4 manganese dioxide batteries, lithium-silver vanadium oxide batteries and lithium-iodide  
5 batteries, and wherein said secondary battery is selected from the group consisting of lithium-ion  
6 batteries.

1 Claim 27 (original): A method in accordance with Claim 21 further including voltage boosting in  
2 order to charge said secondary battery at a voltage that is higher than a voltage output of said  
3 primary battery.

1 Claim 28 (original): A method in accordance with Claim 27 wherein said voltage boosting  
2 comprises inductive voltage boosting.

1 Claim 29 (original): A method in accordance with Claim 27 wherein said voltage boosting  
2 comprises capacitive voltage boosting.

1 Claim 30 (original): A method in accordance with Claim 29 wherein said voltage boosting  
2 comprises producing charging pulses of sufficiently short duration to reduce the discharge rate of  
3 said primary battery to a level that is compatible with the maximum discharge current capacity  
4 thereof.